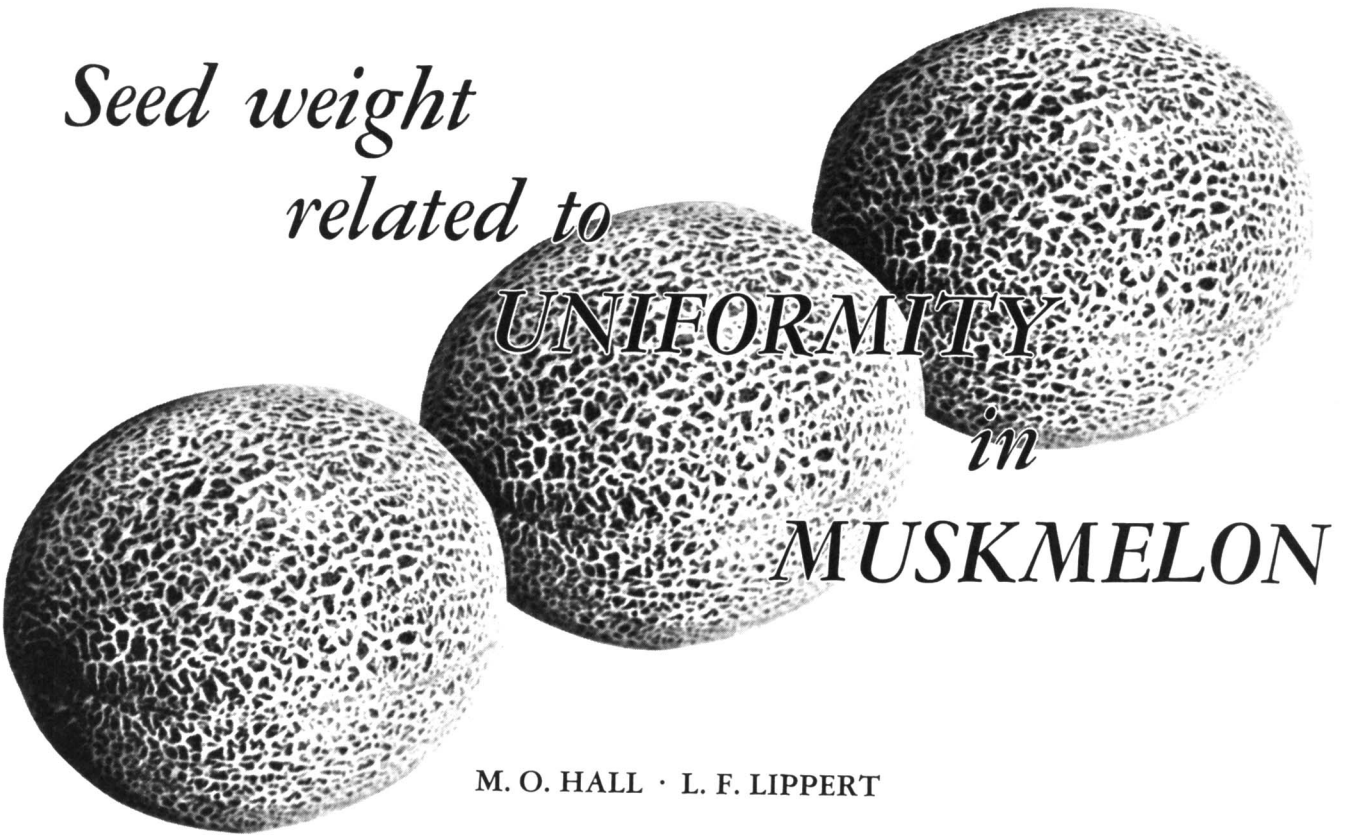
Seed weight related to UNIFORMITY in MUSKMELON



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Evidence from these greenhouse studies indicates an advantage in uniformity of emergence and seedling vigor from size-graded seed of muskmelon. However, additional research is necessary to properly utilize this relationship of seed size to seedling emergence and vigor under field conditions.

UNIFORMITY OF ALL PHASES of plant growth is important in muskmelon production. Many separate factors influence growth from initial placement of seed to final maturity and harvest of the crop. Uniformity is particularly important with the present increased interest in mechanized harvest.

To begin evaluation of factors affecting uniform growth in muskmelon, a series of laboratory and greenhouse studies were conducted on variations in muskmelon seed weight, associations of seed weight to uniformity of emergence, and seedling vigor and plant growth.

Eight lots of commercially produced muskmelon seed, four each from cultivars PMR 45 and Topmark, were evaluated for range of seed weight. Of the various methods of seed separation attempted (in-

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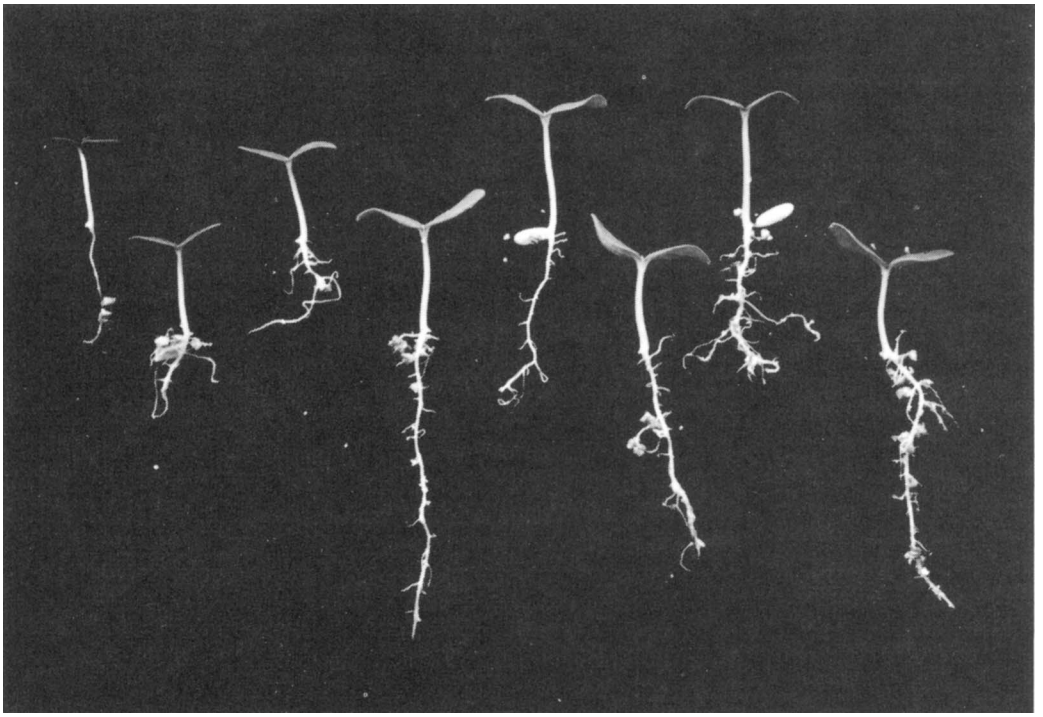
THE GRAPEFRUIT: Its Composition, Physiology, and Products. Walton B. Sinclair. $15.00. A book that will be of interest to botanists, nurserymen, growers, biochemists, dietitians, processors, and students. The author, an emeritus professor of biochemistry at U.C., Riverside, draws upon a lifetime of work and experience with citrus fruits and brings together the latest available information on the origin, history, market statistics, biochemistry, and the factors influencing quality and yield of grapefruit. He also discusses by-products and the timely topic of water pollution in connection with the manufacture of by-products. A hard-bound book with nearly 600 pages of text, 187 figures, 195 tables, and an extensive bibliography.

IRRIGATION ON STEEP LAND. Cir. 561. This publication describes the different types of irrigation methods that are being used on steep lands.



Muskmelon seedlings from 4 weight classes 4 days after emergence from vermiculite. Top row, Topmark (left to right) 10–15, 15–20, 20–25, and 25–30 mg seed weight classes. Bottom row, PMR (left to right) 15–20, 20–25, 25–30 and 30–35 mg classes.

cluding air column separation and size screening), only actual weights of individual seeds provided the size classes necessary for this study. Two hundred seeds of each lot were weighed and separated into five groups ranging from 10 to 15 mg up to 30 to 35 mg, in 5 mg increments. The percentage distribution for each seed lot is presented in the first five columns of table 1.

There was considerable variation in seed weights both within seed lots and between seed lots. In general, 40 to 50% of the seeds weighed in the median 20 to 25 mg group. An additional 20 to 30% were distributed one weight class above or one class below this median level, depending upon seed lot. The extreme classes, either lightest or heaviest, accounted for 2 to 15% of the total samples.

These variations in seed weights prompted removal of seed coats from seeds within each lot and each size group, reweighing the cotyledons and embryos, and calculating the percentage of the total seed weight composed of nonseed coat fractions. The average percentage by lots (column 6, table 1) and within size groups (last row, table 1) show relatively uniform percentages by weight for embryo and cotyledon. Therefore, seed weight appears to be a reliable measure of growth potential for muskmelon seed.

Seedling emergence

For germination studies, 150 of the weighed seeds were chosen at random from each seed lot. These 150 seeds were divided equally into three groups: (1) normal or whole seeds, (2) whole seeds with the seed coat intentionally cracked, and (3) cotyledon and embryo only, with seed coats removed. Each group was planted ¾-inch deep into vermiculite in the greenhouse. The day of emergence was recorded for each seedling, and weights of 14-day old seedlings were recorded to the nearest 0.1 gram.

Average days to seedling emergence, percentage emergence three days after appearance of the first seedling, and the correlation of seedling weight with seed weight are presented in table 2. It was apparent that the seed coat in some manner adversely affected early and uniform seed germination and seedling emergence because within each seed lot cracking or removing the seed coat accelerated seedling emergence. Lots 4 and 8 (least affected by the seed coat) were freshly harvested seeds from our breeding program, whereas the remaining lots represented commercial samples. Seed samples from each lot were rechecked one year later, with similar results—suggesting that age of seed was not the major factor accounting for the emergence differential.

Correlations indicated a fairly high association between seedling weight and seed weight, ranging from +.550 to +.824, but these values were not statistically significant. However, using r^2 as an estimator of the association between characters, 31 to 67% of the variation in seedling weight was directly associated with variations in seed weight.

Subsequent growth

Three separate trials using seeds of four different weight groups from PMR 45 and Topmark cultivars were conducted to relate influence of initial seed weight on subsequent plant growth. The results from the three trials (which differed only in length of the growth period) were similar, so that only data from the trial with the longest growth period are summarized.

Four days after emergence from vermiculite, seedlings were transferred to a balanced liquid nutrient solution. The design consisted of two plants from each seed weight per container, replicated four

times. Runner length was measured 21 and 28 days after transplanting, and total plant weight was taken 60 days after transplanting (table 3).

The appearance of seedlings from the four weight classes at time of transplanting is shown in the photo. In both muskmelon cultivars, total runner length per plant increased as seed weight increased, with a two-fold, significant increase between extreme seed weight groups. Plant weight at 60 days also showed the trend of heavier plants from the heavier seeds. However, variations among weights of individual plants—even the two plants within a single container—was great, and mean plant weights from the various seed weight groups were not significantly different. Thus, an advantage for vigor and growth is conveyed to the plant by the greater initial weight of the seed, but this advantage is modified later by variable growth among plants caused by environmental influences.

Vigor

Also examined was the effect of date of seedling emergence on subsequent vigor of the plant. Seedlings from two seed weight classes (10 to 15 mg and 25 to 30 mg) of Topmark cultivar were transplanted from vermiculite to liquid nutrient solution 4 days after they emerged. Treatments representing seedlings emerging 6, 7, 8 and 9 days after seeding were established, with two plants per container and four replications. Data were recorded for days from seeding to diameter of second leaf measuring ½ inch, plant height, runner length and plant weight (table 4).

During the early growth period, plants resulting from the heavier seed were more vigorous than plants from lighter seed. Also, seedlings which emerged the earliest retained an early growth advantage over seedlings which emerged later. However, as the plants matured, differences among individual plants of the same treatment were so great that treatment differences were not significant.

Two preliminary trials have been conducted to compare these greenhouse results with results under less controllable field conditions. In both trials, neither an earlier emergence nor a more uniform emergence was associated with either heavier seeds, or with cracking or removing the seed coat.

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TABLE 1. PERCENTAGE DISTRIBUTION OF SEED WEIGHTS OF EIGHT SEED LOTS OF TWO MUSKMELON CULTIVARS

Cultivar and Seed Lot		Weight groups in mg					Percent embryo and cotyledon
		10–15	15–20	20–25	25–30	30–35	
		%	%	%	%	%	%
Topmark	1	13.5	39.5	40.0	6.0	1.0	59.3
	2	1.5	37.5	55.0	5.5	0.5	60.5
	3	7.5	34.5	47.0	10.0	1.0	59.1
	4	1.0	10.0	39.0	44.0	6.0	58.3
PMR 45	5	1.0	12.0	53.0	30.0	4.0	60.7
	6	6.5	20.5	47.5	22.5	3.0	61.4
	7	13.0	49.0	32.0	6.0	—	59.8
	8	1.0	13.5	45.0	34.0	6.5	59.9
Mean percent embryo and cotyledon		59.5	59.9	60.2	58.8	60.3	

TABLE 2. EMERGENCE OF MUSKMELON SEEDLINGS FROM NORMAL AND MODIFIED SEED TREATMENTS, AND CORRELATIONS OF SEEDLING WEIGHT WITH SEED WEIGHT

Seed lot	Normal seed		Cracked seed		Naked seed		r values—seedling weight to seed weight
	Avg no. days	Percent* 3 days	Avg no. days	Percent 3 days	Avg no. days	Percent 3 days	
1	14.2	51	6.6	96	6.1	100	.701
2	14.6	10	11.8	50	6.9	98	.683
3	7.4	76	6.2	98	6.1	100	.824
4	6.7	100	6.6	100	6.2	100	.557
5	13.1	72	6.1	100	6.1	100	.550
6	7.6	88	6.2	100	6.2	100	.612
7	12.3	30	9.0	72	6.6	94	.654
8	6.3	100	6.3	100	6.2	100	.559

* Percent of total emergence during the 3 days after the initial seedling emerged.

TABLE 3. INFLUENCE OF SEED WEIGHT ON SEEDLING VIGOR AND PLANT GROWTH

Cultivar	Topmark*					PMR 45*				
Seed wt (mg)	10–15	15–20	20–25	25–30	LSD_{05}	15–20	20–25	25–30	30–35	LSD_{05}
Runner length (cm) 21 days	21.8 b	41.0 a	47.2 a	52.2 a	18.1	31.5	48.2	59.8	63.2	ns
Runner length (cm) 28 days	62 c	95 bc	107 ab	140 a	36	82 c	108 bc	144 ab	162 a	34
Plant weight (g) 60 days	75	116	144	164	ns	92	148	188	192	ns

* Mean separation, in rows within cultivars by the Duncan's Multiple Range test, 5% level.

TABLE 4. EFFECT OF SEED WEIGHT AND EMERGENCE DATE OF SEEDLING ON PLANT GROWTH. TOPMARK CULTIVAR

Seed weight	15–20 mg*				25–30 mg*				LSD_{05}
Days to emergence	6	7	8	9	6	7	8	9	
Days to 2nd leaf ½ inch diameter	16.8 b	17.6 bc	19.1 d	20.2 e	15.5 a	16.8 b	17.9 c	19.4 de	0.9
Plant height (cm) 29 days	4.2 cd	3.4 def	3.2 ef	2.8 f	6.9 a	5.8 b	4.8 c	3.9 cde	0.8
Runner length (cm) 35 days	12.4 cd	10.6 de	9.6 de	7.8 e	20.9 a	17.0 b	14.5 bc	11.2 cde	3.7
Runner length (cm) 42 days	109 cd	106 cd	85 d	81 d	190 a	165 ab	140 bc	107 cd	43
Plant weight (g) 64 days	176	174	160	150	216	211	195	158	ns

* Any 2 means in rows not having letters in common are significantly different at the 5% level by the Duncan's Multiple Range test.